THE FOREST ARBORETUM

OHIO AGRICULTURAL EXPERIMENT STATION

Special Circular No. 40

Spruce and fir

The white pine forest

THE FOREST ARBORETUM

The forest and ornamental plantings at the Ohio Agricultural Experiment Station comprise approximately 70 acres and are known as the Forest Arboretum. A few plantings of hardwoods were made as early as 1901 to 1905, but the development of the Arboretum did not get under way until 1908, and practically all of the forestry and ornamental plantings have been made subsequent to that year.

THE PURPOSE OF THE ARBORETUM

One purpose of the arboretum is to determine the species of trees adapted for forest planting in Ohio and to determine the silvicultural requirements that will obtain best results in growth and maturity. Experiments have thus been planned to answer many questions that arise in this relatively new field. It is necessary to know what native and exotic species are adapted to our soils and latitude; whether it is better to plant them in pure or mixed stands; if in mixed stands, what associates are best; whether the mixture shall be made by the use of single rows or in checker-board fashion in small groups with 10 to 20 trees of the same species in a group. Underplanting older timber stands is useful, and it is necessary to determine what species are best for this purpose. It is also necessary to know the best spacing to use for trees in forest plantations; the spacing will probably vary for different species. Subsequently, it is necessary to determine the time and rate of thinning trees in plantings in order to facilitate the best growth and development.

In a wide collection of tree species from many parts of the world, such as is found in the Arboretum, it is to be expected that many species will fail under Ohio soil and climatic conditions. It is important to determine the species unsuited to Ohio conditions. On the other hand, it has been possible to bring to this region a number of exotic species which give promise of value for both forestry and ornamental uses. The Corsican pine, for instance, from the mountains of Corsica and the Mediterranean country, to date, has proved to be the most rapid growing of the collection of pines. The Serbian spruce from the Balkan Peninsula promises to be one of the best for ornamental and windbreak uses.

The second purpose of the Arboretum is to determine the species and varieties of trees adapted for ornamental, windbreak, and shelter-belt uses.

There are 361 forestry plots in the Arboretum, many of which are subdivided and composed of several species. Approximately 540 species and varieties are represented in the Arboretum; the number is being increased each year.

Although all of the plots in the plantings are of more or less interest, the following are the more successful ones and are of particular interest to prospective planters who have in mind the establishment of forest plantations for timber production, land use, soil protection, and landscape effects.

OUTSTANDING FORESTRY PLOTS

Christmas tree plot. Norway spruce, white spruce, Douglas-fir, and Fraser fir (named from east to west).—Planted in 1925, using 2-year seedlings. These are the species often planted for Christmas tree purposes in Ohio.

Plot 279. Swamp white oak.—Planted in 1913, using 2-year seedlings. Average diameter, 4.3 inches; average height, 28 feet. This is one of the best of the oak species for planting on moderately fertile sites.

Plot 266. A mixture of different species in double row groups; i. e., two rows of each species.—This type of mixture is of value because it resembles the group mixture in form but is more simple of execution.

Plot 246. Pin oak.—Planted in 1917, using 1-year seedlings. Average diameter, 4.1 inches; average height, 31 feet. It is one of the fastest growing of the oaks.

Plot 236. Sweet gum.—Planted in 1918, using 2-year transplants. Average diameter, 4.3 inches; average height, 30 feet. This is a fast growing tree on bottomland sites.

Plot 212. Corsican pine.—Planted in 1917, using 3-year transplants. Spaced 3 x 3 feet (average diameter, 3 inches; average height, 27 feet) and 6 x 6 feet (average diameter, 4.5 inches; average height, 31 feet). This has proved to be the fastest growing pine planted in the Arboretum although somewhat difficult to establish.

Plot 214. Mixture of red pine and Norway spruce.—Planted in the fall of 1912, using 6-year transplants. Average diameter of red pine, 5.1 inches; average height, 30 feet. Average diameter of Norway spruce, 4.4 inches; average height, 33 feet. Apparently this mixture is favorable for both species in northern Ohio.

Plot 203. Tulip poplar (planted in 1909) and Norway spruce (underplanted in 1913).—Average diameter of tulip poplar, 4 inches; average height, 31 feet. Average diameter of Norway spruce, 2.6 inches; average height, 19 feet. The ability of the spruce to tolerate some shade enables it to maintain itself in such a mixture, although its growth rate is below that of spruce in an unshaded plot.

Plot 201. White oak.—Planted in 1913, using 6-year transplants. Average diameter, 3.7 inches; average height, 27 feet. This plot is typical of the moderately good growth rate of this oak on fairly fertile soil.

Plot 185. Burr oak and arborvitae.—Planted in 1909, using 4-year transplants. Average diameter of oak, 5.1 inches; average height, 26 feet. Average diameter of arborvitae, 3.1 inches; average height, 19 feet. This is typical of the usual results of mixing hardwoods and softwoods on moderately fertile sites.

Plot 200. Norway spruce.—Planted in 1913, using 7-year transplants. Average diameter, 3.2 inches; average height, 25 feet. The marked trees have been selected for the final crop trees and will be favored in subsequent thinnings.

Plot 197. Red oak.—Planted in 1915 with 1-year seedlings. Average diameter of oak, 3.3 inches; average height, 31 feet. Beech planted in 1916 for an understory. Average diameter of beech, 1.3 inches; average height, 15 feet. A mixture of this type, a slow-growing, shade-tolerant species under a faster growing, less tolerant species, produces normal woods conditions earlier than does a pure planting.

Plot 179. Red oak and sugar maple mixture.—Planted in 1918 with 1- and 3-year stock, respectively. Average diameter of oak, 2.9 inches; average height, 24 feet. Average diameter of maple, 2.1 inches; average height, 21 feet. Two spacings were used in this planting (6 x 6 feet and 4 x 6 feet), but the results show little difference in the rate of growth.

Plot 178. Sugar maple.—Planted in 1916 with 1-year seedlings. Average diameter, 2.0 inches; average height, 21 feet. This species is one of the most important of the forest trees found in northeastern Ohio, and, with protection from livestock, the maple reproduces naturally and grows well.

Plot 169. Norway poplar.—Planted in 1915, using 1-year cuttings. This is one of the fastest growing trees in Ohio, producing wood suitable for paper pulp, excelsior, and box boards.

Plot 168. Red and white pine.—Planted in 1917, using 4-year transplants. Average diameter of red pine, 4.7 inches; average height, 25 feet. Average diameter of white pine, 4.1 inches; average height, 25 feet. This mixture is of advantage in case either species is destroyed by insects or disease.

Plots 148, 138, and 127. Ponderosa pine.—Planted in 1915, using 4-year transplants. Three spacings were used; namely, 3 x 3, 3 x 6, and 6 x 6 feet. The widest spacing has produced the best growth (average diameter, 3.8 inches; average height, 20 feet). All but 10 rows in each plot have been pruned of dead branches, and the east halves of the 3 x 3 and 3 x 6 foot plots were thinned.

Plots 149, 137, and 128. White pine.—Planted in 1914, using 6-year transplants. Average diameter, 4.5 inches; average height, 28 feet. Spaced originally 3 x 3 feet.

Plots 150, 136, and 129. Red pine.—Planted in 1914, using 5-year transplants. These plots are spaced 3 x 3, 3 x 6, and 6 x 6 feet, respectively. Average diameter of 6 x 6 spacing, 3.9 inches; average height, 21 feet. The wider spacings have not affected height growth appreciably but have produced greater diameter growth in these plots. Part of each plot has been left unpruned, and the west halves of the 3 x 3 and 3 x 6 foot plots were thinned.

Plots 115, 108, and 93. Scotch pine.—Planted in 1914, using 5-year transplants. These plots are spaced 6 x 6, 3 x 6, and 3 x 3 feet, respectively. Average diameter of 6 x 6 plot, 5.0 inches; average height, 32 feet. The 3 x 3 plot shows greater height but less diameter than the wider spacing.

Plots 116, 107, and 94. White pine.—Planted in 1914, using 4-year transplants. Average diameter, 4.7 inches; average height, 27 feet. Spaced 3 x 6 feet.

Plots 117, 106, and 95. White pine.—Planted in 1914, using 4-year transplants. Average diameter, 5.5 inches; average height, 32 feet. Spaced 6 x 6 feet. The effect of this wider spacing is very noticeable.

Plot 85. Douglas-fir.—Planted in 1914, using 4-year transplants. Average diameter, 3.7 inches; average height, 23 feet. This species, native to the Rocky Mountains, is fairly well adapted to Ohio.

Plot 79. White spruce.—Planted in 1915 with 4-year transplants. Average diameter, 3.9 inches; average height, 22 feet. White spruce is hardy and moderately fast growing in northern Ohio.

Plot 77. Norway spruce.—Planted in 1917, using 6-year transplants. Average diameter, 4.6 inches; average height, 28 feet. Norway spruce is the fastest growing spruce adapted to this region and has a wide variety of uses.

Plot 76. Colorado spruce.—Planted in 1922 with 6-year transplants. The east three rows were selected for their green color, the west four rows for their blue color.

Plot 75. Black spruce.—Planted in 1918 with 4-year transplants. This species, native to swamps in northeastern United States and Canada, grows well in drained sites in this region.

Plot 74. Red spruce.—Planted in 1918 with 4-year transplants. This species is apparently less suited to this climate and soil than the black spruce.

Plot 73. Oriental spruce.—Planted in 1918 with 4-year transplants. This species is native to eastern Asia and is adapted for ornamental uses in this region.

Plot 71. Serbian spruce.—Planted in 1918 with 4-year transplants. Average diameter, 3 inches; average height, 20 feet. This is an unusually attractive spruce.

Plot 70. Red pine.—Planted in 1912 with 4-year transplants. Spaced 4 x 4 feet and 4 x 8 feet. Average diameter, 4.5 inches; average height, 25 feet (4 x 8 plot). The wider spacing apparently increases diameter but not height growth.

Plot 31. Scotch pine and Norway spruce.—Planted in 1912, using 4- and 7-year transplants, respectively. The results in this plot show the necessity of mixing species suited to each other. The Scotch pine has suppressed and destroyed the spruce.

Plot 66. White pine.—Planted in 1911, using 2-year seedlings. Originally spaced closely, the plot was thinned early. Average diameter, 4.5 inches; average height, 34 feet.

Plot 49. Yellow poplar.—Planted in 1911, using 4-year transplants. Typical of the growth which can be expected from this species on fertile, protected sites.

Plot 310. Original mixed planting of ash, catalpa, tulip poplar, and black walnut.—Made in 1905 on old field soil of depleted fertility. Growth first 5 years was very poor. In 1910 hardwoods were interplanted with Norway spruce.

Pines under hardwoods

REJUVENATION OF NATIVE WOODS

The northern end of the Arboretum was typical, at one time, of many open, park-like forests resulting from continuous pasturing. The rejuvenation of such areas is a problem. It may be solved by allowing nature to reestablish a forest (a slow process) or by planting artificially with species adapted to this purpose.

The plots in this woods are part of a study of the methods which may be used in this work and of the species best suited for conditions found here. They are illustrative of the results which may be obtained in a short time by planting with certain of the evergreen species, showing growth, survival, and (where there is rolling land) the effective checking of erosion.

Plot 42. Hemlock.—Planted in 1914, using 5-year transplants.

Plot 35. Yellow poplar.—Planted in 1913, using 4-year transplants. This species is fast growing in fertile, protected sites and produces a high-grade lumber.

Plot 52. Red pine.—Planted in 1914, using 6-year transplants. This planting was made on an eroding slope and has successfully checked all washing.

Plot 28. White pine.—Planted in 1914, using 7-year transplants. This underplanting of pines in an open, hardwood stand illustrates one method of reestablishing a forest on an area.

Plot 24. Hemlock.—Planted in 1914, using 6-year transplants. Hemlock is one of the best evergreens to use under a partial shade.

Plot 14. European silver fir.—Planted in 1915, using 6-year transplants. This is adapted for underplanting in a hardwood stand.

OUTSTANDING ORNAMENTALS

Among the more outstanding evergreen ornamentals for home and park use the following will be of interest:

The Yews in variety.

The Spruces—Oriental, Serbian, black, white, Colorado, Engelmann, and Norway.

The Pines—White, Macedonian, Himalayan, Korean, Mugho, Limber (Rocky Mountain white), Pacific Coast Ponderosa, and Jeffrey.

The Firs—Nordmann, Greek, Spanish, Veitch, Fraser, Douglas, *concolor*, Arizona, Noble (blue form).

The fir group contains some of the most beautiful trees in the collection.

Junipers—Pfitzers, Virginia blue, *communis*, Montana, Sargents, Japanese, Fountain, *canaertii*, Reeves (globe), Meyer, Bar Harbor, and *communis depressa plumosa*.

Arborvitae—Western (variety *atrovirens*), *orientalis nana aurea*, Standish, Columbia, Hoveys, Woodward globe, Berckman, *elegantissima*.

Cypress—Nootka, *Lawson allumii*, Sawara, *plumosa*.

Larch—Golden larch, Japanese.

Hemlock—Canadian, Carolina, Japanese.

The native forest at the Experiment Station, a part of the forest arboretum